INITIAL ENGINEERING, TESTING, AND DESIGN OF A COMMERCIAL-SCALE POSTCOMBUSTION CO$_2$ CAPTURE SYSTEM ON AN EXISTING COAL-FIRED GENERATING UNIT

CO$_2$ Capture Technology Project Review Meeting
August 14, 2018
Pittsburgh, Pennsylvania

Jason Laumb, Principal Engineer
PROJECT TEAM AND INDUSTRY SPONSORS

- State of North Dakota – Mike Holmes, LEC/LRC
- ALLETE (BNI, ACE, and MP) – Bill Sawyer
- Minnkota Power – Craig Bleth, Stacey Dahl
- MHI – Tim Thomas, Mike Fowler
- Burns & McDonnell – Ronald Bryant
- EERC – Jason Laumb
GOALS AND OBJECTIVES

• The goal of the project is to determine retrofit costs for a postcombustion CO₂ capture system on an existing coal-fired electric generating unit. Specific objectives to support this goal include the following:
  – Design a fully integrated postcombustion CO₂ capture system for Milton R. Young Unit 2 (MRY2).
  – Evaluate KS-1 solvent on lignite coal-derived flue gas to refine critical design parameters.
  – Complete a techno-economic assessment (TEA) in accordance with DOE’s bituminous baseline study (B12B).
  – Complete a pre-front-end engineering and design (FEED) analysis of the specified postcombustion CO₂ capture system at MRY2.
PROJECT STRUCTURE

• Task 1 – Project Management and Planning
• Task 2 – Testing Demonstration at MRY2
• Task 3 – Techno-Economic Assessment
• Task 4 – Project Engineering and Design
• Task 5 – Pre-FEED Cost Estimate
PROJECT TIME LINE

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<th>Task Description</th>
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<td>Task 2.0 – Testing Demonstration at MRY</td>
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<td>2.1 – Amine Testing</td>
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<td>Task 5.0 – Pre-FEED Cost Estimate</td>
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<th>Deliverables</th>
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<td>D1 – Updated PMP</td>
<td>M1 – Initiated Field Testing</td>
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<td>D2 – Updated TMP</td>
<td>M2 – Design Basis Determined</td>
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<td>D3 – Complete TEA</td>
<td>M3 – Complete TEA</td>
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<td>D4 – HAZOP Review</td>
<td>M4 – Complete Preliminary Pre-FEED Analysis</td>
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<td>D5 – Constructability Review</td>
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PROJECT DETAILS – MRY2

- Minnkota Power MRY2
  - 477-MW lignite-fired unit
    - OFA
    - SNCR
    - Halogenated PAC
    - ESP
    - Wet FGD
  - Provides power to eastern North Dakota and northern Minnesota
PROJECT DETAILS – CAPTURE TECHNOLOGY

- MHI Capture Technology
  - KM CDR Process (KS-1 Solvent)
    - Flue gas pretreatment
    - CO₂ recovery
    - Solvent regeneration
    - CO₂ compression and dehydration
  - Based on technology used at Petra Nova
PROJECT DETAILS – CAPTURE INTEGRATION

- Fully integrated steam supply system
  - IP/LP crossover
- 95% capture on MRY2 entire flue gas stream
  - 12,157 tons/day
- Solvent reclaiming
  - Based on field tests
- Aerosol mitigation technology
  - Aerosol impacts based on testing
PROGRESS TO DATE

• Project design basis nearing completion.
  – 95% capture on entire flue gas stream
  – 12,157 tons/day
• Preparation for testing at MRY2.
  – Site visit
  – Test plan development
  – System integration with baghouse
FUTURE WORK

• Finalize project design basis.
  – 1 month out
• Balance of plant
  – Steam study
  – Permitting
• Install test equipment at MRY2.
  – Fall 2018
• Initiate pre-FEED cost analysis.

"PREDICTIONS ARE DIFFICULT, ESPECIALLY REGARDING THE FUTURE."

NIELS BOHR
CONTACT INFORMATION

Energy & Environmental Research Center
University of North Dakota
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018

www.undeerc.org
701.777.5114 (phone)
701.777.5181 (fax)

Jason D. Laumb
Principal Engineer, Coal Utilization Group Lead
jlaumb@undeerc.org